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## RECONSTRUCTIVE RECALL\*

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By GARRY C. MYERS and CAROLINE E. MYERS, Brooklyn

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It is common observation that if one fails in an attempt to recall a bit of one time familiar experience, later one may recall numerous remnants of it, and may reproduce the greater part or even all of that experience.

With a purpose to estimate how far one can recall what seems to have been forgotten, and to determine some of the conditions under which the forgotten can be reconstructed the following study has been undertaken.

The six subjects were instructed to try to reconstruct from memory, one or more selections, which they once readily could quote, but which in the meantime, they almost completely had forgotten. They were told to make their attempts at recall at regular intervals or at the most convenient time. They were asked to introspect and were urged especially to note as far as possible the conditions under which the recalls were made. Some worked at several selections over the same period of time. Others worked upon only one at a time, and, when they had given that up in despair they turned to another selection. The period of time over which the subjects worked varied from a few weeks to several months.

One subject recalled at regular intervals; she carefully noted her time for recall which was generally ten minutes. The other five were irregular in intervals, and length of recall times, and one of these merely indicated the order of the recalls without regard to the time when they were made. Two subjects, G. M. and C. M., made several recalls in a day and they spent from 5 minutes to an hour at recalls. Only three indicated the interval between learning and recall. There could hardly be an absolute certainty as to the absence of recalls during these intervals. One subject, G. W., was certain she had no recalls of one selection while she stated she had many recalls of another selection, during the interval.

Since not all the materials readily admit of statistical analysis some typical records will be quoted and some of their prominent characteristics will be pointed out.

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\* Reported, in brief, at the November (1915) meeting of the New York Branch of the American Psychological Association.

The following from Lincoln's Gettysburg Address was given by Miss T.

'Four score and twenty? years ago our fathers brought forth on this continent a new nation conceived in liberty and dedicated to the proposition that all men are created equal. We are met on a great battle field of that nation. We have come to dedicate a portion of that field as a final resting place for those who here gave their lives that that nation might live.'

Note—"I also remembered part of the last phrase—'of the people, by the people and for the people.'

The question mark after *twenty* means that my common sense told me it could not be *twenty*, altho I wrote that number and could not remember the right one. I started the test January 26, 1915, and took twenty minutes every morning for the experiment."

January 27th. "I remember that somewhere near the middle of the address there were the words 'above our power;' that some people said 'our poor power,' but I knew I had been told that 'poor' should not be there."

January 28 to January 31 "I added no new words."

February 1. "While playing the piano and being seemingly very interested in a new piece I was trying, I suddenly found myself saying, 'The world will little note nor long remember what we say here but it can never forget what they did here.'"

February 2. "When I opened to the first page of a book I just got from the library I saw written 'To J. R. D. I dedicate this book.' The word *dedicate* seemed to remain with me and even at dinner I found myself saying it. Then when I started to think of the selection I remembered that part of it went thus: 'But (?) — we cannot dedicate we cannot consecrate we cannot — this ground.'"

February 3. "In the morning when my mind was on the experiment and I deliberately tried to remember more of it I got only the very last few words, 'shall not perish from the earth.'"

February 4, 5, 6. "No new words. On the 5th in talking to a friend H. B. about another individual X, H. B. said she thought X should carry on the noble work which her mother (X's mother) had been striving so hard to finish. I suddenly remembered that that idea was expressed in the Gettysburg Address somewhat this way: 'It is for us the living to carry on the unfinished work which those who fought here have — so — advanced.'"

February 7. "In the evening I sat down and tried to say the address right off and thus got some new words. After a few attempts, probably 6 or 7, I found I had picked up two new words. In the sentence 'But we cannot consecrate we cannot dedicate we cannot hallow this ground. *Hallow* was a new word. I went on and finally got a good deal more as follows: 'The brave men living and dead, who struggled here have consecrated it far above our power to add or detract.' The words 'above our power to add' I had had before.

"I also got the rest of the sentence of February 5th as follows: 'It is for us the living rather to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced.'"

February 8. "In the assembly hall to my regret the pupils said the Gettysburg Address. —"

"My test of remembering this speech brought up many facts, ideas and people that I had forgotten since my elementary school days."

Subject G. W., after an interval of nine years, recalled, in 16 trials over 13 days, 65 per cent of the "Wreck of the Hesperus." Of this, 44 per cent was added after the first recall. Variations and confusions were very pronounced. "For a long time," she wrote, "the first verse seemed to be,

'It was the schooner Hesperus,  
That had sailed the wintry sea!'  
'By the long gray beard and glittering eyes,  
Now wherefore stoppest thou me?'

"These last two lines from the Ancient Mariner would persist in preventing my progress."

Of her fifth and sixth trials she wrote: "Badly mixed up with Ancient Mariner."

Confusions within the poem were frequent. For example, of the stanza,

"He wrapped her warm in his seaman's coat,  
Against the stinging blast;  
He cut a rope from a broken spar,  
And bound her to the mast."

she recalled in the third trial, *rough* for *seaman's*; *lashed* for *bound* and omitted *stinging*, and *broken spar*. She placed the fourth line for the second. Five days later she got *stinging blast*, but could not place it until the final reconstruction, after six more days. This delay in proper placing till the final recall was quite frequent for G. W., as well as for some of the other subjects. In her final recall she interchanged the third and fourth lines of stanzas XI and XII, respectively, whereas in her first recall they were correctly placed. Likewise in her third trial she crossed out a half line of a stanza and substituted a wrong phrase, but corrected it in the final recall. Both stanzas XV and XXII have as rhyming words, *snow* and *Norman's woe*. When, however, she recalled *driven snow* where she should have *carded wool*, in stanza XVIII, she immediately gave *Norman's woe* as the rhyming word. Space does not admit of her many other substitutions, confusions, doubtful factors, and omissions.

The same subject added 33 per cent of the Psalm of Life in 8 subsequent recalls. In her first recall of stanza IV she got line 1 and 4, but could get none of line 2. She thought however, that line 3 ended in *heart is beating*. This really is the gist of lines 2 and 3:

"And our hearts though stout and brave,  
Still like muffled drums are beating."

On the evening of the same day she recalled the whole stanza correctly.

Subject G. M. added 44 per cent in four subsequent recalls of the same poem. In his fourth trial he recalled: "Art is long and time is fleeting" and "funeral marches to the grave," but did not know that they belonged to the same stanza. Later in the same day he got:

" — — — — drum beat  
Funeral marches to the grave."

Then he recalled:

"Art is long and time is fleeting,  
And our hearts though stout and brave."

"When this was written," he noted, "I got *drum beat* for the end of the third line; then *Still like* came up, then *drum beating*, then came *muffled drums* and all at once,

"Still like muffled drums are beating  
Funeral marches to the grave."

For him the following lines from "The Present Crisis" frequently obtruded but were seldom accepted as true:

"We ourselves would pilgrims be  
Launch our Mayflower and steer boldly  
In the desperate winter sea."

#### WOODMAN, SPARE THAT TREE

Recalled by Miss M. S.

No. 1.

I

- 1st Trial. Woodman, spare that tree! Touch not a single bough;  
In youth it sheltered me and I'll protect it now;  
2d Trial. 'Twas my forefather's hand that placed it near his cot  
There, woodman, let it stand, thy axe shall harm it not!

Note—"In the 2d trial the last line of the stanza came to me before the third line. I kept repeating the first two lines over and over again trying to remember some more. I remembered a movement of my hand that I had been taught when I said, 'There,' this gave me a cue to the last line. I tried to find a word that rhymed with 'not.' When I thought of 'cot' I remembered the rest of the line."

No. 2.

II

- 8th Trial. That old familiar tree, its glory and renown  
7th Trial. Are spread o'er land and sea, and would'st thou hew it  
down?  
3rd Trial. Woodman forbear thy stroke! Cut not its earth-bound  
ties;  
5th and  
6th Trial. Oh! spare that aged oak now towering to the skies.

Note—"Some one asked me what I was trying to remember; when I told them they said 'That old familiar thing; anyone could remember that,' then I got the first line of the stanza."

"I was listening to a speaker who said 'The blood of our best men is spread o'er land and sea,' and involuntarily I supplied, 'and would'st thou hew it down.' Try as I would I could get no more."

"I recalled that when I was learning the poem I had been told to say it as though I were entreating some one then I remembered the third line but could not place it in the poem."

"In this trial a friend who had heard me reciting some of the poem and was impatient for me to join her shouted, 'For goodness sake spare many and come on,' then I thought of the first half of line four."

"When I repeated the poem I remembered that—'Oh! spare that aged oak' came after line 3, stanza II. When I said the two together I got the rest of the fourth line."

No. 3.

III

- 8th Trial. When but an idle boy I sought its grateful shade  
10th Trial. In all their gushing joy, here too my sisters played;

4th Trial. My mother kissed me here; my father pressed my hand,  
1st Trial. Forgive this foolish tear, but let that old oak stand!

Note—In the 10th trial "I finished reading a letter which was remarked as gushing. When I sat down to recall some of the poem I remembered 'here too his sisters played in all their gushing joy,' When I tried to fit it into the verse I found that I had remembered it backwards."

In the 4th trial "I had been thinking for a long time but got nothing new. At last I read what I had written and I began wondering what it was that made him cry in line 4 verse III. Then I remembered that it was something about his mother and father. I repeated to myself 'My mother and father,' 'My mother and father' until I thought of the line."

When the subject got the 4th line of this verse she could not locate it in the poem.

No. 4.

#### IV

11th and

12th Trial. My heart-strings round thee cling, close as the bark old friend!

13th Trial. Here shall the wild bird sing and still thy branches bend.  
Old tree, the storm thou'lt brave, and woodman leave the spot;

While I've hand to save thy axe shall harm it not.

Note—In the 11th trial "I had just finished reading 'Apollo and Daphne'. Daphne turns into a tree and her garments become her bark. This made me get the last half of line 1."

In the 13th trial "While I was telling a story to a group of children one of them annoyed me so much that I finally said 'Jack, leave the room.' I said it so dramatically that we all laughed and when I was thinking of it later it reminded me of the way I had said 'Woodman, leave the spot.' Then the verse came to my mind."

In the 9th trial the subject got nothing new.

She did not indicate the date of each trial.

One can see that, although the lines came up in the most perverted order they, as well as the stanzas, finally found their proper places.

#### QUOTATIONS FROM "SNOW BOUND"

Recalled by G. M. after an interval of ten years.

- "1. The sun that brief December day
2. Rose cheerless over hills of gray,
3. And, darkly circled, gave at noon
4. A sadder light than waning moon,
5. Slow tracing down the thickening sky
6. Its mute and ominous prophecy,
7. A portent seeming less than threat,
8. It sank from sight before it set.
9. A chill no coat, however stout,
10. Of homespun stuff could quite shut out,
11. A hard, dull bitterness of cold
12. That checked, mid-vein, the circling race
13. Of life blood in the sharpened face,
14. The coming of the snow-storm told.
15. The wind blew east; we heard the roar
16. Of Ocean on his wintry shore,
17. And felt the strong pulse throbbing there
18. Beat with low rhythm our inland air."—The original.

Notes—On January 12th the subject recalled the first eight lines correctly except that he substituted "A" for "Its" in line 6. At this first recall he also got lines 11, 15, 16, 17, 18, and two lines from Quotation II.

Lines 9 and 10 were recalled correctly on January 16th but it was not until February 1st that they were marked "Sure."

Line 11.

Jan. 12th. A dull chill bitterness of cold

Jan. 16th. A dark dull bitterness of cold

Feb. 1st. A hard dull bitterness of cold (correct)

Line 12.

Jan. 16th. Thought line ended in "race".

Later. That checked mid-life the — face,

Later. That checked mid-vein the encircling race,

Line 13.

Jan. 16th. Of life blood in the hardened face,

Jan. 17th. Of life blood in the darkened face,

Line 14. Omitted.

Line 15.

Jan. 12th. Correct.

Feb. 1st. Placed it after line 13.

Lines 16 and 17.

Jan. 12th. Correct.

Line 18.

Jan. 12th. Beat with low rhythm the wintry air.

Jan. 15th. Beat with low rhythm our inland air.

#### QUOTATION II.

- "1. Unwarned by any sunset light
2. The gray day darkened into night,
3. A night made hoary with the swarm,
4. And whirl-dance of the blinding storm;
5. As zigzag wavering to and fro
6. Crossed and recrossed the winged snow;
7. And ere the early bedtime came
8. The white drift piled the window-frame,
9. And through the glass the clothes-line posts
10. Looked in like tall and sheeted ghosts."—The original.

Line 1.

Jan. 23rd. And ere the early candle light

or

Long ere the time for candle light

Jan. 26th. Unwarned by sunset's mellow light

Jan. 27th. And ere the time for — — —

Feb. 1st. And ere the time for candle light

Feb. 7th. Line above was marked correct.

Line 2.

Jan. 16th. The twilight softened into night,

Jan. 26th. The gray day softened into night, (Marked "sure")

Feb. 1st. Same as above. *Darkened* had been crossed out and *softened* written in.

Feb. 7th. The gray day darkened into night, (Correct)

Line 3.

Jan. 27th. A night made hoary with the blast

Feb. 1st. A night made (wretched with the flow)—doubtful

Later. A night made bitter by the blasts

- Feb. 7th. A night made bitter by the frost  
 Later. A night made dreadful with the storms  
 Feb. 11th. A night made blinding by the swarm (Marked "sure")  
 Line 4.  
 Jan. 27th. Of snow flakes driving thick and fast;  
 Feb. 1st. Of snow flakes and the driving snow;  
 Later. Of snow flakes and the rising masts;  
 Feb. 7th. And ghost like with the rising forms;  
 Feb. 11th. Of snow flake and the blinding storm;

Note—Grouping lines 3 and 4 of the same date the vain attempt to reconstruct by rhyme is manifest.

Lines 5 and 6.

- Jan. 14th. Correct.

Line 7.

- Jan. 12th. And ere the early bed-time (or evening) came  
 Jan. 19th. And when the early evening came  
 Later. And ere the early bedtime came

Line 8.

- Jan. 12th. The snow had piled the window frame  
 Jan. 13th. The snow drifts piled the window frame

Line 9.

- Jan. 12th. Appeared the covered posts  
 Jan. 13th. And from below the covered posts  
 Jan. 14th. And from below the haunted (or mounted) posts  
 Jan. 19th. — — — — — posts  
 Jan. 23rd. And from without the mounted posts  
 Jan. 27th. And from without the snowclad posts  
 Feb. 5th. And from without the vaunted posts  
 Feb. 12th. And from without the clothes-line posts

Line 10.

- Jan. 12th. — — — — — haunting ghosts  
 Jan. 13th. Looked in like tall and sheeted ghosts.

#### THE PAINTER OF SEVILLE BY SUSAN WILSON.

Recalled by C. M.

Subject C. M. over a period of nine months reconstructed 132 lines of a poem of 183 lines which she had not recalled for about 5 years. Although her records show a gain of 101 lines in the 10 subsequent recalls over the first recall, space does not permit a complete analysis of her data. In her final recall only 15 words and phrases were wrongly used. There is no absolute certainty, however, that the selection had not been learned with some of these wrong words. While the substitutes are rarely synonyms almost all of them have obvious likeness in meaning to the correct words and none make a break in the story's thread. Some of them were *gleamed* for *beamed*, *proving how fruitless is the teacher's power* for *to prove how vain must be the teacher's care*, *fair for rich*, *failed to tell for did not tell*, *whispered for murmured*, *gleamed for shone*, *enrapt for absorbed*, *humble for trembling*.

The variations in words and phrases in successive recalls are worthy of note.

1. Only a *boy* the *lad* had seen Feb. 8th became  
 Almost a *child* the *lad* had seen Feb. 9th (a) became  
 Almost a *child* the *boy* had seen Feb. 9th (b) (Correct) became  
 Almost a *child* the *lad* had seen Final. Nov. 1st.
2. *Gleaming* Feb. 8th became *glowing* Final (Correct).



3. *Shed* or *spread* Feb. 9th became *shed* (correct) Final.
4. *Softly* Feb. 9th became *mildly* (correct) became *kindly*. Final.
5. *Watch* Feb. 9th became *guard* (correct) May 4th and Final.
6. *And answered* March 18th became *and whispered* July 27th became *and said "I swear it"* Nov. 1st and Final.
7. *Shone* July 28th (a) became *glowed* July 28th (b) became *gleamed* (incorrect) July 29th and Final. *Beamed* was correct.
8. *Morning sunlight* or *early sunlight* July 28th became *early sunlight* (correct) Final.
9. *Gleaned* or *fell* July 29th became *gleamed* (correct) Final.
10. *Choice pupils* July 29th (a) became *young aspirants* July 29th (b). *Young aspirants* (correct) Final.
11. *Showing* or *proving* or *to prove* (correct) July 29th became *proving* Final.
12. *Teacher's part* July 29th (a) became *teacher's task* July 29th (b) became *teacher's power* (incorrect) Final. *Teacher's care* was correct.
13. *Long got knowledge* July 29th (a) became *unbought knowledge* (correct) July 29th (b) and final.
14. *Painter* or *Murillo* Feb. 9th became *Murillo* (correct) Final.
15. *Toiled* Feb. 13th (a) became *worked* Feb. 13 (b) became *joyed* Feb. 13th (c) (correct) and final.
16. *So be thee from this day* Feb. 13th became *So be thee from this time* (incorrect) Final. *So be thee mine by other bonds* was correct.
17. *Stroke* Feb. 15th became *touch* (correct) Final.
18. *Pressed* Feb. 13th became *clasped* March 18th became *pressed* (correct) Final.

One may conclude from the above that the "corrections" are practically always made in the right direction and that the errors are in words and not in content. In her introspections the subject stated: "I always got the story before the words." "When the lines 'But constant to his purpose still. He toiled to see his pupil gain' were first recalled I gave *worked* and then *toiled* for *joyed* but realized that it was incorrect. I knew that there was the thought that Murillo found pleasure in helping Sebastian. This thought was not expressed in *toiled* or *worked* but came with *joyed*."

There are two sections of the poem lines 1 to 18 and 64 to 72 which have similar beginnings:

"'Twas morning in Seville; and brightly beamed  
The early sunlight in one chamber there;  
Showing, where'er its glowing radiance gleamed,  
Rich varied beauty."

and

"'Twas midnight in Seville; and faintly shone  
From one small lamp a dim uncertain ray,  
Within Murillo's study."

Until the 18th recall the subject gave lines 64 to 72 as the beginning of the poem. It was at this time that lines 1 to 4 were recalled.

In connection with lines:

"Nor dare to close your eyes in sleep  
If on the morrow morn you fail  
To answer what I ask  
The last shall force you—do you hear?  
Hence to your daily task."

The subject confused a phrase of another poem—"The Vision", "Thy faithfulness to show." "This phrase came up every time I got

here and disturbed my going farther altho I knew it did not belong here."

In the final recall when the parts from the previous recalls were put together 12.5 lines were added and distributed as follows: 1, 1, 1, 8, 1.5. The subject did not realize, however, that these were being added. This fact emphasizes the interdependence of associated units, and is a vivid example of now-conscious memory.

Usually the recalls were made in groups of several lines. One rhyming word brought up another line. One line or part of one line rarely came up alone. She recalled at very irregular intervals. When February 14th she succeeded in dragging herself to do her best she made several recalls during the evening. She became obsessed with the task and was disturbed on lying down to sleep, by incompleted parts fleeting through her mind. She awoke in the night recalling some new parts. The whole day following she was distressed by the feeling of failure to recall what she was sure she could recall. During the day and previous evening she added in all 25 lines. Probably several hundred attempts were made with one part or another. The experience was so unpleasant that the subject ignored it and refused to write any recalls and tried to forget all about it so that although 4 lines came up 2 days later no more recalls, nor attempts at recall, were made until July 29th. She again evaded the task until November 1st. She noted then that if she could only get a few connecting words she could finish it. After reading the original to compare it with her final recall she repeated the entire poem in perfect order with only 9 words wrongly used.

In the table appended the numbers in each column opposite the ordinates represent the number of lines in the successive recalls. The total of each column is followed in order by the number of lines in the original selection, the per cent of the entire selection which was given in the first recall, the per cent added by subsequent recalls, the total per cent recalled, the number of attempts at recall and the number of days in which recalls were made.

Although the first recall was the best for each selection a number of subsequent recalls are not very inferior. The efficiency decreases with succeeding recalls but the decrease is by no means constant. On the average almost 50 per cent of the original selection was added after the first recall. It should be noted that at the end of practically every recall the subject felt certain that no more could be added then, although the feeling that more could be added by keeping at it long enough was reported a number of times. Indeed with enough trials, perfect reconstruction might not have been impossible. There seems to be no correlation between the first recall and the total of subsequent recalls. The individual with the second lowest per cent for first recall made by far the greatest gain in the total subsequent recalls. The ratios of the first recall to the total of subsequent recalls are .45, .75, 1.66, .23, 1.71, .29. From the above facts one may conclude

## AMOUNT, GAIN AND DISTRIBUTION OF RECALLS

|  | Wreck of the Hesperus<br>—G. W. | Psalms of Life<br>—G. M. | Psalms of Life<br>—G. W. | Woodman, Spare that<br>Tree—M. S. | Lady of the Lake<br>—M. W. | Painter of Seville<br>—C. M. |
|--|---------------------------------|--------------------------|--------------------------|-----------------------------------|----------------------------|------------------------------|
| 1.....                                       | 18                              | 12                       | 20                       | 3                                 | 6                          | 30.5                         |
| 2.....                                       | 14                              | 4                        | 1                        | 2                                 | 1                          | 10.5                         |
| 3.....                                       | 3                               | 8                        | 0                        | 1                                 | 1.5                        | 12.5                         |
| 4.....                                       | 3                               | 4                        | 2                        | 1                                 | 0                          | 8                            |
| 5.....                                       | 10                              | 0                        | 6                        | .5                                | .5                         | 8                            |
| 6.....                                       | 4                               |                          | 1                        | .5                                | .5                         | 3                            |
| 7.....                                       | 0                               |                          | 1                        | 1                                 |                            | 2                            |
| 8.....                                       | 0                               |                          | 1                        | 2                                 |                            | 7                            |
| 9.....                                       | 1.5                             |                          | 0                        | 0                                 |                            | 3                            |
| 10.....                                      | 0                               |                          | 1                        | 1                                 |                            | 1                            |
| 11.....                                      | 0                               |                          |                          | .5                                |                            | 4                            |
| 12.....                                      | 3                               |                          |                          | .5                                |                            | 10                           |
| 13.....                                      | 0                               |                          |                          | 3                                 |                            | 1.5                          |
| 14.....                                      | 2                               |                          |                          |                                   |                            | .5                           |
| 15.....                                      | 0                               |                          |                          |                                   |                            | 5                            |
| 16.....                                      | 0                               |                          |                          |                                   |                            | 2                            |
| 17.....                                      |                                 |                          |                          |                                   |                            | 2                            |
| 18.....                                      |                                 |                          |                          |                                   |                            | 4                            |
| 19.....                                      |                                 |                          |                          |                                   |                            | 5                            |
| 20.....                                      |                                 |                          |                          |                                   |                            | 12.5                         |
| Total number of lines given..                | 57.5                            | 28                       | 32                       | 16                                | 9.5                        | 132                          |
| Number of lines in poem . . .                | 88                              | 36                       | 36                       | 16                                | 10                         | 183                          |
| Per cent given in first recall..             | 20.4                            | 33.3                     | 55.5                     | 18.8                              | 60                         | 16.6                         |
| Per cent added in subsequent<br>recalls..... | 44.9                            | 44.4                     | 33.3                     | 81.2                              | 35                         | 55.5                         |
| Total percentage given.....                  | 65.3                            | 77.7                     | 88.8                     | 100                               | 95                         | 72.1                         |
| Number of attempts at recall.                | 16                              | 5                        | 9                        | 13                                | 6                          | 20                           |
| Number of days covered in<br>recalls.....    | 13                              | 5                        | 8                        | 13                                | 6                          | 10                           |

that the final recall is not a fair measure of retentiveness; much less is the first recall such a measure.

Because a number of the lines recalled from "Snowbound" by G. M. underwent so many changes and since he made no final reconstruction of all the recalls no attempt to enumerate his recall was made. Reference to his recalls readily show a comparatively high amount of the total recall given in the first recall. Those lines given in his first recall he had recalled very frequently during the five years interval but the suc-

ceeding lines had practically always failed to come up and had consequently been ignored. He reported the same for the first recall from the "Psalm of Life." G. W. whose first recall also was relatively high made a similar report. This corroborates experimental evidence of the value of recalling material once learned in assuring its retentiveness.

#### RECALLING NAMES OF CLASSMATES

The writer G. C. M. tried to recall over a period of three months the names of his 76 classmates (1905). During that year he readily knew each one by name.

Feb. 24. He recalled the names of 31 and the faces of 3.

Feb. 26. He added 7 names and 3 faces.

Mar. 1. He added 6 correct and 2 incorrect names, the latter being marked *doubtful*.

Mar. 3. He began to recall by order of the alphabet and added 6 correct and 4 incorrect names (marked *doubtful*). Carter was given for Arter; Dixon for Hixon, and among the correct recalls was the name of one whose face only was recalled on Feb. 24th and 26th.

Mar. 6. He added 5 correct names, and 4 incorrect of which 3 were marked *doubtful*.

Mar. 8. He added 4 names. Arter was disguised in Alter but after a few minutes became Arter.

Mar. 10. He added one correct and one incorrect (*doubtful*) name. "Here I got the name of her whose face I had recalled several times before but for whom no other name but *Apples* and *Cider* would come up. She had often suggested these things to me while we were at school together. There was nothing in the sound of the name to suggest these words."

Mar. 12. He added two wrong words labelled *doubtful* and gave up in despair after 7 minutes although all previous recalls lasted for 15 minutes or more.

Apr. 22. He added 2 correct words, making a total of 62.

Immediately after this recall he saw a picture which he had not seen during the experiment thus far, of all the class save one, and recognized only 56. "I later discovered that some I had recalled I could not recognize. I probably had recalled their names by mere sound associates. I did not look over the recalls in the meanwhile."

May 14. Sixty were recognized. G, S and B neither recalled nor recognized before, and one not recognized before were given. "The name of certain ones not recalled in looking over the picture, sometimes came up after I had passed

on to others; for example, for the face of X, I could not get a name but I felt troubled because I was certain I really knew her name. After writing the names of the next three, not trying to think of X, her name flashed to my mind. This happened quite frequently in recognition. Of course the imperfection of the photograph might be responsible for some poor recognitions.

C. E. M. ran the same test on herself with practically the same results.

Some other studies of delayed recall may be of interest here. Colvin<sup>1</sup> concluded that "recall after 24 hours seems to be as good, on the whole, as immediate recall, when tested by the method of parts retained." Similar findings were reported by Radossawljewitsch.<sup>2</sup> Huguenin<sup>3</sup> found that the number of lines of poetry which can be recalled ten minutes after learning is less than the number reproducible at any subsequent time (up to eight weeks). The writer elsewhere found that of 47 boys, "21 gave more words in the second recall (after one hour) than in the first (immediate) recall,—with an average of two-tenths of a word more in the second than in the first recall." Forty-five out of 73 girls gave more in the second recall, with an average of .97 words more. For both sexes, from one to six correct words were added in the second or third recall.<sup>4</sup>

### CONCLUSIONS

On the average the gain in the total subsequent recalls was about half as much as the original selections and about twice as much as the first recall.

Certainty for validity of recall was surprisingly safe, while certainty of inability to recall more at any time was highly unsafe. The more frequent the recalls, however, the more reliable the certainty for each. Recalls marked *doubtful* were incorrect as a rule but a few marked *wrong* were correct.

Although some errors persisted throughout most were corrected in subsequent recalls. More attempts at correction were made when all the recalls were reconstructed into a unit (final recall) and these attempts were nearly always suc-

<sup>1</sup> Colvin, S. S. Development of Imagination in School Children. *Psychol. Rev. Mon. Sup.*, 1909, 11, 85-124.

<sup>2</sup> Radossawljewitsch. Das Behalten und Vergessen bei Kindern und Erwachsenen nach experimentellen Untersuchungen. Leipzig, 1907.

<sup>3</sup> Huguenin, C. Revivescence paradoxale. *Arch. de psychol.*, 1914, 14, 379-383.

<sup>4</sup> Myers, G. C. Recall in Relation to Retention. *J. Ed. Psychol.*, 1914, 5, 119-130.

cessful. In all recalls the changes made were generally in the right direction. When alternatives were given the correct one almost invariably survived. Unreasonableness of a recall, at times challenged its correction. Errors were in words and rarely in content; the content, as a rule, was recalled before the words. In a few cases remnants from foreign selections obtruded themselves causing considerable confusion.

Feeling and general attitude of the subject toward the task factored highly in the recall-performance. Frequently the subjects reported that they could get more if they would keep at it but they could not drive themselves to try. A few were "captured" by the task so that it could not be dismissed at will. For them many remnants were recalled at the most unexpected moments.

Casual suggestions by sounds, sights, movements, ideas and feelings served to call up remnants in various proportions. For some subjects this was very pronounced while for others it was rare.

Recall of rhyming words proved a great aid in bringing up the rest of the respective lines.

The parts of the selections were not always recalled in order, nor were they reported in order, except in final reconstruction. Even within a stanza or a paragraph, recalls sometimes were made in the most perverted order.

There was practically no correlation between the first recall and the total subsequent recalls.

Selections with many recalls previous to the experiment were reproduced much better than those with few or no recalls.

These findings go a long way to substantiate the belief that, "We never wholly forget anything." Certainly we do not forget nearly so much as we think we do, and one's inability to recall facts on demand, is no proof that one has really forgotten them.

The recall time which has been almost wholly neglected in memory experiments is probably as important in measuring memory as the learning time. At best, persistency of the subject is a big factor in recall.

Pedagogically one may infer that if the teacher were skillful enough in questioning and in general presentation the most of what seems to have been forgotten by the pupil could be recalled as needed. Likewise if all that is studied could be properly correlated, the amount to be memorized would be comparatively small.

Motive, and deep seated interest on the part of the learner

not only incite to greater activity, but, by evoking non-conscious recall they assure better results from the same expenditure of effort.

#### SOME SUGGESTIONS

In the light of this study a few suggestions are offered:

1. Wherever possible recall time should be measured or standardized.

2. Some method should be devised for recording quantity and quality of recalls during the various stages of the recall time.

3. Further correlations of recall time with learning time and with recall performance should be studied for each recall.

4. Incorrect recalls should be taken into consideration and their transition through subsequent recalls for each individual should be noted.

5. Whenever possible, a number of subsequent recalls should be made. The more numerous they are and the greater the time over which they are spread the more instructive they probably would be. Subsequent recalls should not be expected by the subject.

6. Some scheme might be devised whereby certain suggestions could be measured as to their influence in evoking correct recalls.

7. Perhaps delayed recall offers the richest field for memory study.

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